CATV RECEUVER

P9020

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ISSUE B

MARCH 1973

INSTRUCTION MANUAL

CATV RECEIVER

P 9020

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KAY ELEMETRICS CORP
Pine Brook, NJ
201-227-2000

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CATV RECEIVER P 9020

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SECTION I

GENERAL INFORMATION

I.I INTRODUCTION

The P9020 is a plug-in head for the 9000 series Kay Scope mainframe. Together with a suitable Kay RF sweep generator, they comprise a Transmitter-Receiver system for analyzing the frequency-amplitude characteristics of a CATV system. The transmitter is located at the head-end and the receiver is connected at points throughout the system to check the operational performance (See Figure I Typical Hook-up). The Transmitter and Receiver may be adjusted to produce various sweep scanning times and repetition rates, so that tests may be made with minimum system interference.

I.2 SPECIFICATIONS

INPUT IMPEDANCE	75 ohms
SENSITIVITY	3.0 mv optimum (50 DBMV)
OUTPUT	Operation to 1.0 VRMS (60 DBMV) with built-in attenuator
POST AMPLIFIER	40 db--Flatness 0.5 db, 5-300 MHz
FREQUENCY MARKERS	Crystal-controlled pulse type (picket fence) switchable markers appearing at every 5 MHz and every 50 MHz. The 50 MHz markers are approximately twice the amplitude of the 5 MHz markers. The 5 MHz markers are difficult to use at scan rates faster than 2 milliseconds.

1.3 INSTALLATION

Unpacking: Upon receipt of the instrument, visually inspect it for any damage that may have occurred during shipment. Please report any damage to the carrier and to the KAY ELEMETRICS CORP.

SECTION II

OPERATION

2.1 DESCRIPTION OF CONTROLS

INPUT ATTENUATION (DB)	Six-step, 0 to 41 db in 1 db steps. Used to obtain correct input signal level and to establish attenuation references for determining system flatness.
FREQ. MARKERS (Switches)	Enables switching of 5 and 50 MHz markers ON or OFF.
FREQ. MARKER LEVEL	Controls marker amplitudes; continuously variable.
SCAN-FREQ. (Variable)	Selects the scanning rate from 2 to 5 milliseconds. This control should be set so that the Receiver scan rate corresponds to the Transmitter scan rate. The scan rate is the time required to sweep through the 5 to 300 MHz frequency spectrum.
SCAN-TRIG (Variable)	Selects the scanning generator sensitivity. This control is adjusted to produce the optimum horizontal scan trigger for a given RF input level and noise ratio.
FILTER ON-OFF (Switch)	This switch allows a video filter to be connected to the receiver output. This filter is useful in reducing noise and video interference from the frequency response display. The filter should be switched OFF when analyzing sharp suck-outs, as it may cause the suck-out to appear shallower than it actually is.

MARKER ADJ.		These two screwdriver adjustment controls are located beneath the FREQ MARKERS switches. They should be adjusted to obtain optimum marker operation. They will require readjustment only with extreme changes in RF signal input level.
TILT ADJ.		This screwdriver adjustment is used to tilt the frequency response curve to compensate for high frequency cable losses. The frequency response is flat when the control is set to maximum ccw; the high frequency output increases as the control is adjusted in the cw direction to a maximum tilt of approximately 5 db.
NOTE The following controls are present on Models after and including Serial Number 2-X (i.e. 2-1 2-2, etc.)		
EXT/INT TRIGGER SWITCH		Selects either INT or EXT Horizontal Triggering.
	INT	Selects INTERNAL Horizontal Triggering directly from the received signal.
	EXT	Allows EXTERNAL Triggering from a video signal obtained from an external source. This allows a field strength meter to supply the triggering voltage which may be tuned to any desired frequency in the FSM frequency range. In the EXT mode the P9020 trigger filtering is removed, minimizing the horizontal time delay between the Transmitter signal and the Receiver response.

2.2 CHECK-OUT PROCEDURE

A. Connect the Transmitter output to the Receiver input. Turn on Receiver and Transmitter power switches.

B. Set Transmitter frequency range to sweep from 0 to 300 MHz. (Using Summation Sweep Multi Sweep 159D)

C. Set Transmitter and Receiver Scan Rate to 5ms and Transmitter repetition rate to a rate that provides easy viewing (5 Hz or more).

D. Adjust Receiver amplifier input level to approximately 5mv using the Receiver and/or Transmitter attenuators.

E. Set Kay Scope controls to the following settings:

INTENSITY	Mid-range
FOCUS	Mid-range
VERTICAL POSITION	Mid-range
VERTICAL A AMPLITUDE	Mid-range
VERTICAL B AMPLITUDE	Maximum ccw (not used with P9020)
HORIZONTAL MODE Switch	EXT
HORIZONTAL RATE Switch	Not operational in EXT mode position
HORIZONTAL POSITION	Mid-range
HORIZONTAL AMPLITUDE	Mid-range
STORAGE SCOPES	See that STORE buttons are in the OFF position--not depressed.

F. Using Beam Finder, adjust HORIZONTAL and VERTICAL POSITION controls so that a trace appears on CRT. Adjust Intensity and Focus controls for optimum viewing.

G. Insert sufficient signal attenuation so that the Receiver RF amplifier is not overloaded (Intensity level approximately 10 DBMV after Receiver attenuator). Advance the TRIGGER ADJUST control in a cw direction until a triggered sweep is obtained on the CRT.

H. Alternately adjust the VERTICAL AMPLITUDE and POSITION, HORIZONTAL AMPLITUDE and POSITION, and SCAN TRIG controls so that the CRT display representing the Transmitter output appears centered in the CRT face.

NOTE

The sweep retrace intensity is blanked to reduce the CRT phosphor burn hazard when a P33 long persistance tube is used. There is no hazard with Storage tube models.

I. Switch ON the 50 MHz markers and adjust Marker Level. Adjust Receiver Scan Time so that a 0-300 MHz sweep is displayed.

J. Check Storage operation:

1. Push UPPER and LOWER STORE buttons and UPPER and LOWER ERASE buttons and see that they remain in the depressed condition.

2. Push ERASE button to clear CRT.

3. Set Transmitter Sweep Rate to approximately 1 sweep every 4 seconds. Reduce Intensity control setting after one trace has been stored.

4. Refer to Scope manual for further Storage instructions concerning split-screen operation.

2.3 TYPICAL SYSTEM OPERATION

A. Set up the Transmitter (sweep generator) and Receiver as described in the Check-Out Procedure noting that the Receiver, Transmitter scan rates are synchronized at approximately 3 or 4 milliseconds.

B. Refer to Figure 1 for typical system hook-up. Measure the cable signal level at the point of sweep signal injection. Select a directional coupler (with a known insertion loss) to connect the sweep signal into the system. Adjust the output level of the Transmitter so that the sweep test signal will be approximately 15 db above the signal level at the coupler output.

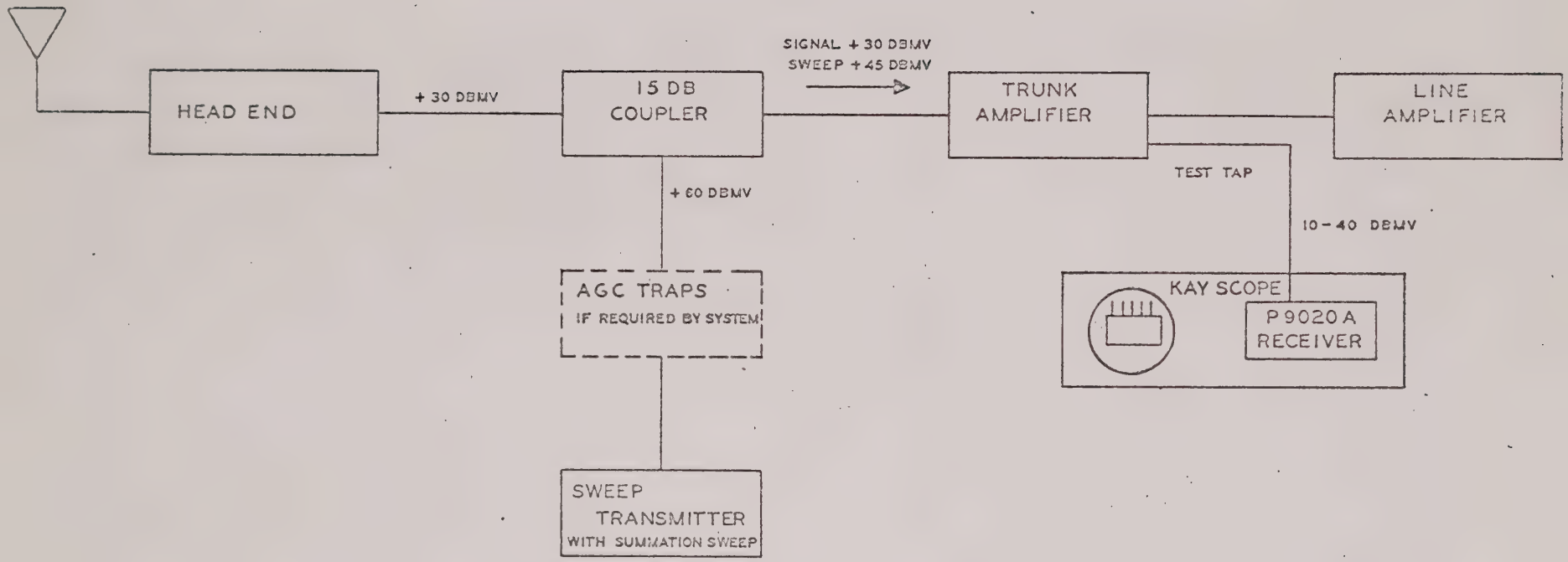

FIGURE 1. SYSTEM OPERATION - TYPICAL HOOK-UP
SCAN TIME: 5 MS
REP RATE: 1 SWEEP / 8 SECONDS

C. Set the Transmitter sweep rate at approximately one sweep every 8 seconds (.125 Hz rep rate). Connect the Transmitter to the coupler.

D. Connect the Receiver to the Test tap at the main trunk amplifier. Decrease the Receiver input attenuation until a convenient display is observed (Approximately +40 DBMV after the attenuator). Adjust the SCAN TRIGGER control for optimum triggering; set the full display with no false triggering on noise pulses.

E. To measure the flatness of the system insert small attenuation steps for calibration.

To obtain an accurate display of system characteristics, the Receiver should be connected with a drop cable whose high frequency losses have been predetermined and compensated for with the Receiver TILT control.

F. If amplifier adjustments are required, leave each sweep stored on the scope. This allows the technician to see the effects of his adjustments.

G. The Receiver may now be taken from point-to-point thru the system measuring each amplifier output and recording the response.

NOTE

AGC ACTION-Some commercially available amplifiers have faster AGC circuits than others. That is, they may tend to compensate for abnormal high levels quicker than other models. In these fast acting AGC systems, the AGC may try to pull down the sweep signal, at the AGC frequency, thus distorting the sweep. It is suggested that, in these instances, the technician install a carrier trap at the output of the sweep transmitter. (See Figure 2) The system will no longer see a high sweep level at the carrier frequency and therefore, the test signal will not be affected.

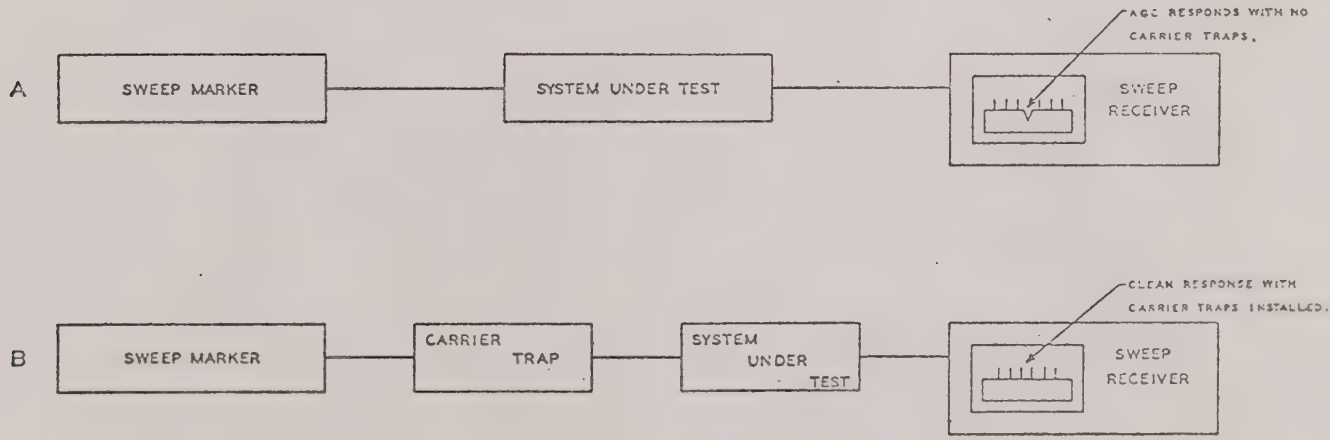

FIGURE 2: (A) SYSTEM & INTERCONNECTORS WITHOUT CARRIER TRAP.
(B) SYSTEM & INTERCONNECTORS WITH CARRIER TRAP ADDED.

SECTION III

ALIGNMENT PROCEDURE / MAINTENANCE

3.1 INTRODUCTION

There is a twofold purpose for including the information contained in this section. Primarily, the Alignment Procedure can be taken in part to supplement the CHECK-OUT PROCEDURE (Section 2.2) or it can be used in its entirety (i.e. without making any of the prescribed adjustments) as a general overall check of the equipment. Used in this manner, it is intended to aid the operator in performing a thorough inspection after parts replacement or to assist in normal periodic maintenance. The Block Diagram (Figure 3) should contribute to the understanding of the components which make up this equipment and of the function they perform.

Secondly, in its complete form, this section will assist maintenance personnel in performing an accurate re-alignment and repair of the instrument. The Block Diagram is provided to explain the general theory of operation and the schematic is included for troubleshooting and parts replacement.

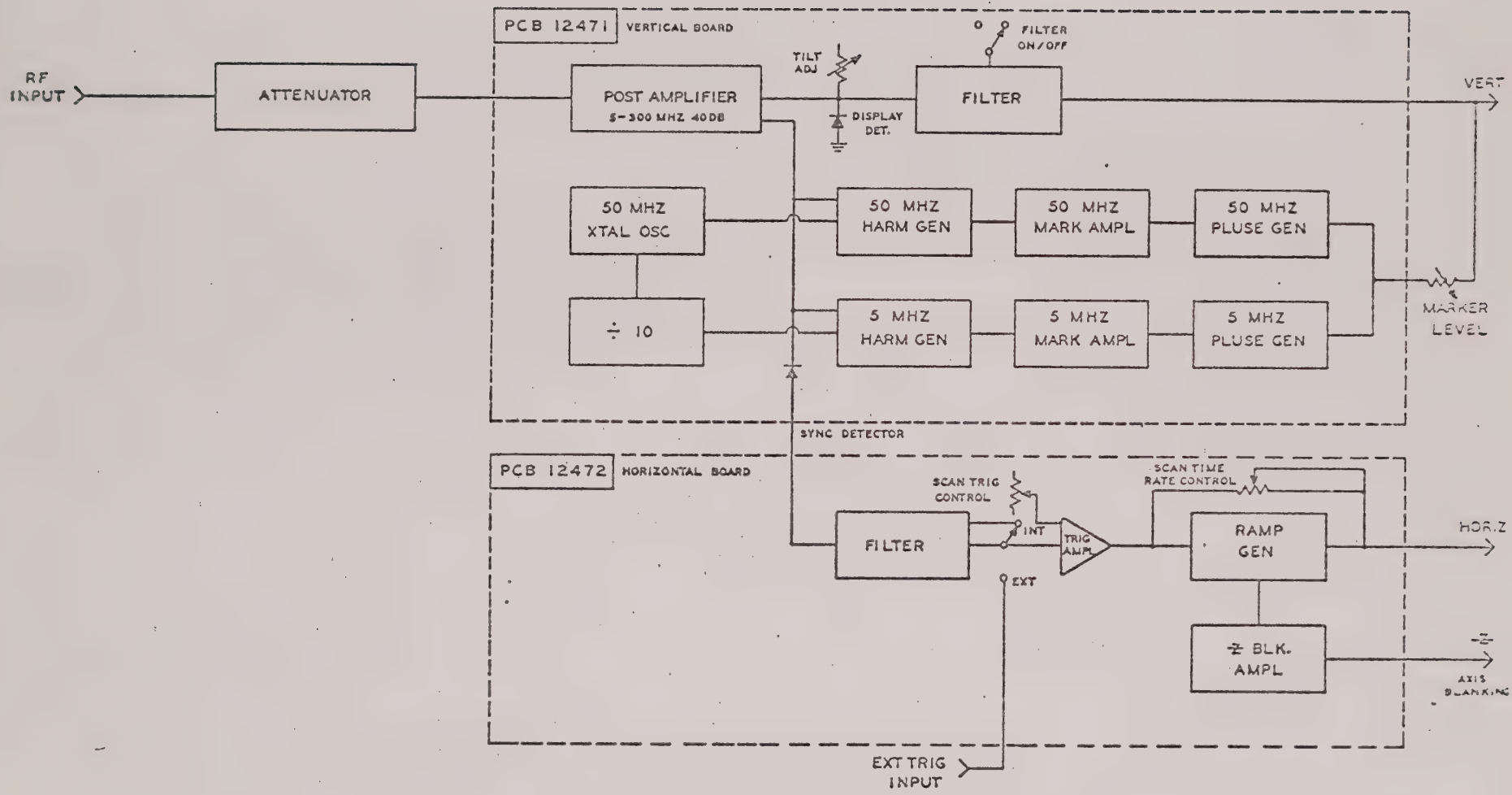

FIGURE 3. BLOCK DIAGRAM CATV RECEIVER 9020.

3.2 EQUIPMENT REQUIRED

SWEEP GENERATOR (0-300 MHz Range)	Cabl-Sweep P9059 Multi Sweep 159 with Summation Sweep Marka Sweep 160 with Summation Sweep Multi Sweep 162 with Summation Sweep
OSCILLOSCOPE (with X10 probe)	Tektronix 503 or equivalent
VTVM	RCA Voltohymst or equivalent
ATTENUATOR (75 ohm with 0-41 db range, not required with Multi Sweep 159)	Kay Model 441B
RECEIVER TEST JIG	Special modification (See Diagram, Figure 4)
VOLTAGE REGULATED POWER SUPPLIES +30 volts at 300ma -30 volts at 75ma	Kepco Model ABC30-0.3 or equivalent

NOTE

If the Test Jig is not available, a Voltage Regulated Power Supply of +5 volts at 50ma will also be necessary.

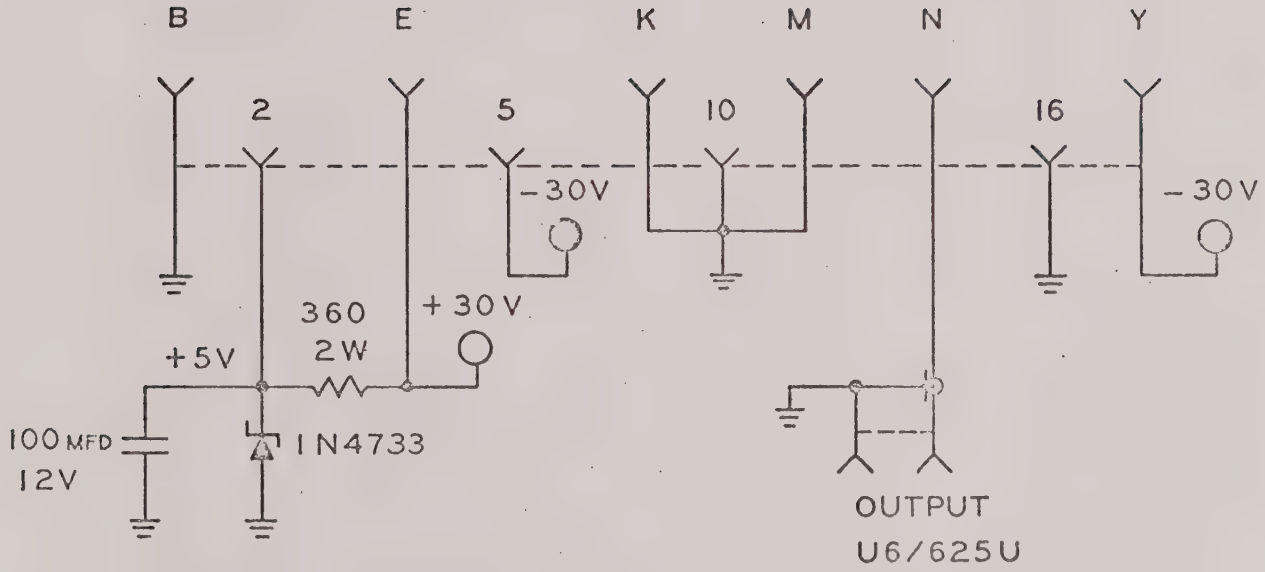

FIGURE 4: SCHEMATIC OF CATV RECEIVER P9020A TEST JIG.
TYPE CONNECTOR - CONTINENTAL 600-11-56

3.3 PRELIMINARY CHECK

A. Connect Power Supplies to Test Jig. (If Test Jig is not available, connect supplies directly to Receiver Board #12471 as follows: +30 volts PIN 5A, -30 volts PIN 21A, +5 volts PIN 2B.)

B. Plug Receiver Board #12471 into Test Jig and turn power supplies ON.

C. Measure Receiver zener power supplies and note that they are within ±10% of specified voltages.

-6 volts - junction R191 and D107 on PCB #12471
-12 volts - junction R221 and D201 on PCB #12472
+12 volts - junction R222 and D202 on PCB #12472

3.4 AMPLIFIER ALIGNMENT

A. Connect Sweep Generator output to Receiver input terminal. (If Cabl-Sweep is used, connect output to external 75 ohm attenuator and then to Receiver input.) Use cable at least 4' long between attenuator and receiver to make match adjustments.

B. Turn Sweep Generator ON and set for the following conditions:

OUTPUT	1.0 VRMS
FREQUENCY	0-300 MHz
SWEEP RATE (Using Summation Sweep on Multi Sweep 159)	15 Hz Line Lock (60 Hz ÷ by 4)
SWEEP SCAN RATE	5.0ms
SCOPE VERTICAL	Connect to Output terminal on Test Jig
SCOPE HORIZONTAL	Connect to Horizontal output terminal of Sweep Generator
TILT ADJ	Maximum counterclockwise
FILTER	OFF

C. Post Amplifier Input Match and Flatness Adjustment

1. Insert 40 db attenuation at the Sweep Generator attenuator. Remove all Receiver attenuation. Display appearing on CRT represents amplifier frequency characteristics. Tune C164 input trimmer so that ripples on the response trace are minimized (should not exceed 5% of overall amplitude). Remove long RF input cable and replace with short length (approximately 1 foot or less).

2. Tune RF Amplifier coils for flat output (±0.5 db) from 5 to 300 MHz. In some instances it may be necessary to select another value for the emitter peaking capacitors C154 or C155. The amplifier cover will have some effect on the high frequency flatness, so the final check should be made with the cover in place. Output should be approximately 0.2 volt base line to maximum. Switch out 13 db and note that overload (change in flatness) does not occur.

3. Set TILT ADJ to maximum cw and see that output amplitude tilts so that 300 MHz increases by approximately 5 db. Reset TILT ADJ to maximum ccw.

3.5 FREQUENCY MARKER ADJUSTMENT

A. Switch on 50 MHz FREQ MARKER switch. Set MARKER LEVEL control to 1/4 maximum cw. Set both MARKER ADJ controls to mid-range. Remove scope vertical from Test Jig.

B. Connect X10 scope probe of test oscilloscope to junction of C134 (.002µf) and R164 (10K). Tune L105 (50 MHz xtal oscillator tank) so that the six 50 MHz harmonic birdie markers are at maximum and equal amplitude.

C. Disconnect scope probe and reconnect scope vertical to BNC terminal on Test Jig. Pulse markers should appear at 50 MHz intervals from 50 to 300 MHz. Markers should operate with no missing or spurious spikes over approximately 20 db input range when varying the MARKER ADJ control over its range. (32 to 52 db below 1.0 volts, 2.5-25 DBMV).

D. Switch ON 5 MHz marker switch. 5 MHz pulse markers should be present and operate over the same input level range when adjusting the 5 MHz MARKER ADJ control over its range.

E. Turn the MARKER LEVEL control for maximum output. The amplitude of the 50 MHz markers should be approximately 0.2 volts and of the 5 MHz markers approximately 0.05 volts.

3.6 HORIZONTAL CIRCUITS

A. Connect scope X10 probe to PIN A12 on the horizontal board #12472.

B. Insert 50 db of attenuation. Adjust SCAN TRIGGER control toward maximum cw direction until a 10 volt (±5 volts) triangle wave appears on the scope.

C. Set Scope Horizontal Display to Normal, 2ms/cm sweep time. Set SCAN FREQ control to 2ms and see that width of 1/2 the triangle (peak to base line) is 2ms or less. Set the SCAN FREQ control to 5ms and see that 1/2 triangle width is 5ms or more.

D. Switch out all attenuation and see that triangle remains.

E. Connect X10 scope probe to PIN A25. See that Z axis blanking pulse is present and amplitude is approximately -8 volts at leading edge. (Pulse will decrease to approximately -5 volts at trailing edge.)

3.7 FINAL CHECK

A. Install Receiver in Kay Scope plug-in cavity. Insert 50 db attenuation. Connect 1.0 VRMS from Sweep Generator to RF input terminal using short 75 ohm cables. Check following conditions:

1. Output flat 5-300 MHz (±.5 db) with TILT ADJ maximum ccw. TILT ADJ range set to maximum cw, 5 db.

2. 5 and 50 MHz marker operation over range of 32 to 52 db attenuation using MARKER ADJ controls.

3. Sweep triggers to 50 db attenuation using SCAN TRIGGER ADJ control.

4. Sweep Scan rate operates from 2 to 5ms using SCAN FREQ rate control.

5. Check each attenuator step by comparing with corresponding steps in Generator attenuator.

6. See that sweep retrace intensity is blanked off.

7. See that noise filter is operating by noting that marker pulse width at base increases by 3 times when the filter is switched ON.

ADDENDUM #270973-10

CATV RECEIVER P9020C

All units designated P9020C include an AMPLITUDE CALIBRATOR.

A 15 dbmv signal may be switched into the Receiver Input to aid in presetting the Vertical Gain controls and determining the system's signal amplitudes. The following procedure should be used:

1. Connect the P9020C into the CATV system.
2. Depress the BEAM FINDER button and adjust Vertical and Horizontal Position controls.
3. Set the display for Storage Operation.
4. Push the AMP CAL button to inject a 15 dbmv signal into the Receiver Post Amplifier. This will produce a horizontal trace with a vertical offset.
5. Adjust the Scope Vertical position and Amplitude controls so that the CAL trace appears on the center of the screen, with zero reference dot at the bottom.

With the normal system operating levels, the sweeping RF signal should be 15 db over the system carrier levels. If the carrier level is 1 mv (0 dbmv) at the system tap-off point, a half screen display will appear. If the triggered display is greater than half screen, insert attenuation using the INPUT ATTENUATOR to obtain a half screen display. System levels may be calculated by adding the inserted attenuation to 0 dbmv. If 10 db is inserted, then the carrier signal levels at the Receiver tap point is 10 dbmv.

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